Disease Burden of Ischemic Heart Disease in Pakistan and its Risk Factors

Background: World Health Organization (WHO) estimates that in the low-income countries the number of deaths due to cardiovascular disease (CVD) is on steady rise. Eighty percent of the deaths due to CVD and 86% of the global burden of CVD are in the developing countries including Pakistan.

Objectives: It is a pilot study meant to determine the disease burden and risk factors for ischemic heart disease (IHD) in the Pakistani population.

Study Design: Cross Sectional study

Materials and Methods: Information was gathered according to the WHO MONICA protocol from 2000 persons in the population of Islamabad selected randomly. Keeping in view the population distribution in Pakistan, 33% of persons selected were from urban and 67% from rural areas to get balanced results. Of the 2000 persons studied half were males and half females. All persons were over 20 years of age. The parameters studied included age, gender, ethnic origin, marital status, socioeconomic status, blood pressure measurement, smoking history, weight, hip measurement, waist measurement, height, history of documented IHD, family history (of cardiovascular disease, diabetes mellitus, hypertension), serum levels of cholesterol, HDL cholesterol, LDL cholesterol, glucose, urea and haemoglobin and other optional investigations as per WHO MONICA protocol where possible.

Results: Of the 2000 persons studied 125 (6.25%) had documented IHD. Pakistan’s population is currently estimated as 163 million. Only half this population is more than 20 years old. Therefore the results are applicable to 81.5 million persons. The disease burden of IHD is therefore estimated as 5.09375 million. IHD was seen more commonly in men compared to women in all age groups despite variation in other risk factors. Relative difference in CHD prevalence between sexes was largest among the youngest subjects up to 50 years old and smallest among the subjects 58-65 years old. Smoking was much more common in men. Total cholesterol was higher and LDL cholesterol was lower in women, whereas HDL cholesterol was higher in women compared to men. In all age groups and both sexes HDL cholesterol was lower than the desirable levels. Both systolic blood pressure (SBP) and diastolic blood pressure (DBP) were higher than desirable in both men and women and increased further with increasing age. BMI was higher among women in all age groups and was more marked in the older age groups. The prevalence of Type 2 Diabetes Mellitus was higher in women with and without established IHD compared to men, in all age groups and increased in both men and women with increasing age but more so in women.

Conclusion: Pakistan has a high disease burden of ischemic heart disease and also its risk factors

Key Words: Ischemic heart disease, burden, Pakistan, risk factors, gender, smoking, cholesterol, blood pressure, BMI, diabetes mellitus

Introduction

The world today is seeing a new epidemic that would have a devastating effect unless it is stopped. In 2001, 56.5 million people died in the world. Roughly one third of these deaths were due to cardiovascular disease (CVD). CVD would be the cause of more than half the deaths worldwide by the year 2010. In addition every year not less than 20 million people have an acute myocardial infarction (MI) or stroke but survive. CVD is not only the problem of the West.
Eighty percent of the deaths due to CVD and 86% of the global burden of CVD are in the developing countries. Despite the high death rates due to non-communicable diseases, by 2010 the leading cause of death in the developing countries including Pakistan would be CVD. For planning preventive and treatment strategies, the prevalence of the disease and its risk factors must be known. This study was therefore carried out to determine the disease burden of ischemic heart disease in Pakistan as well as that of its risk factors.

Materials and Methods

In this pilot study information was gathered according to the MONICA protocol from 2000 persons in the population of Islamabad selected randomly. One third of this population was from urban and two third from the rural areas of Islamabad representing the general distribution of population in Pakistan. The study population was divided equally between the two genders again representing the gender distribution in the overall population.

The following parameters were studied:

- Age
- Gender
- Ethnic origin
- Marital status
- Socioeconomic status
- Blood pressure measurement
- Smoking history
- Weight
- Hip measurement
- Waist measurement
- Height
- Family history of cardiovascular disease, diabetes mellitus, hypertension
- Serum levels of cholesterol, HDL cholesterol, LDL cholesterol, glucose, urea and hemoglobin
- Other optional investigations as per MONICA protocol where possible
- Known history of IHD

Statistical Analysis: ANOVA was used to test the difference in risk factors between sexes. Multivariate analyses were performed by use of a Cox proportional hazards model. To assess whether the association of risk factors with CHD risk is different in men than in women, first-level interactions between sex and risk factors were tested. To assess the extent to which the sex difference in the risk of CHD may be explained by differences in the risk factors, a model was built including data for both sexes and using sex as an explanatory variable. The model was then completed by addition of the other risk factors. The proportion of the excess risk of CHD in men compared with women that was explained by the differences in risk factors was estimated by comparing the risk ratios of CHD associated with sex before and after adjustment for the other risk factors \( \left( \frac{RR_0 - RR_1}{RR_0 - 1} \right) \), where \( RR_0 \) is age adjusted risk ratio and \( RR_1 \) is age and risk factor–adjusted risk ratio. A similar procedure was used to analyze the extent to which the age-related changes in risk factors may explain the difference in CHD risk between the age groups. The statistical analyses were performed with the SAS statistical programs.

Results

Table I and II show that in both urban and rural populations CHD was much more common in men compared to women in all age groups despite variation in other risk factors. Relative difference in CHD prevalence between sexes was largest among the youngest subjects up to 50 years old and smallest among the subjects 58-65 years old. Majority of the men who had CHD were aged over 57 whereas over half the women with IHD were over 57.

As shown in Table III and IV in both urban and rural populations smoking was much more common in men. Total cholesterol was higher and LDL cholesterol was lower in women, whereas HDL cholesterol was higher in women compared to men so as to result in the same HDL/total cholesterol ratio in the two genders. With age total and LDL cholesterol rose whereas HDL cholesterol reduced in both sexes. In all age groups and both sexes HDL cholesterol was lower than the desirable levels.

Table III and IV also show that both systolic blood pressure (SBP) and diastolic blood pressure (DBP) were higher than desirable in both men and women and increased further with increasing age. Both SBP and DBP were higher in men compared to women although this difference became less marked in the older age groups.

As is evident from Table III and IV BMI was higher among women in all age groups and was more marked in the older age groups. The prevalence of Type 2 Diabetes Mellitus was higher in women with IHD compared to men, in all age groups and increased in both men and women with increasing age but more so in women.

Disease burden of ischemic heart disease is calculated as follows:

- Total population: 2000
- Persons with established IHD: 125
- Percentage of total population with IHD: 6.25%
- Pakistan’s total population: 163 million
- Population 20 years and over (50%): 81.5 million
- Present disease burden of IHD: 5.09375 million

### Table I: Age and sex distribution of patients with established IHD in Urban Population (n=660)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Total Males/ (%</th>
<th>Males with IHD/ (%)</th>
<th>Total Females/ (%</th>
<th>Females with IHD/ (%)</th>
<th>Combined Population</th>
<th>Combined Prevalence/ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 - 50</td>
<td>244 (74%)</td>
<td>14 (5.74%)</td>
<td>253 (78%)</td>
<td>7 (2.77%)</td>
<td>497</td>
<td>21 (4.23%)</td>
</tr>
<tr>
<td>51 - 57</td>
<td>39 (12%)</td>
<td>5 (12.82%)</td>
<td>35 (10%)</td>
<td>4 (11.43%)</td>
<td>74</td>
<td>9 (12.16%)</td>
</tr>
<tr>
<td>58 - 65</td>
<td>26 (8%)</td>
<td>4 (15.38%)</td>
<td>23 (7%)</td>
<td>3 (13.04%)</td>
<td>49</td>
<td>7 (14.29%)</td>
</tr>
<tr>
<td>&gt; 65</td>
<td>21 (6%)</td>
<td>4 (19.05%)</td>
<td>19 (5%)</td>
<td>3 (15.79%)</td>
<td>40</td>
<td>7 (17.50%)</td>
</tr>
<tr>
<td>All ages</td>
<td>330 (100%)</td>
<td>27 (8.18%)</td>
<td>330 (100%)</td>
<td>17 (5.15%)</td>
<td>660</td>
<td>44 (6.67%)</td>
</tr>
</tbody>
</table>

### Table II: Age and sex distribution of patients with established IHD in Rural Population (n=1340)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Total Males/ (%)</th>
<th>Males with IHD/ (%)</th>
<th>Total Females/ (%)</th>
<th>Females with IHD/ (%)</th>
<th>Combined Population</th>
<th>Combined Prevalence/ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 - 50</td>
<td>416 (30.75%)</td>
<td>18 (4.33%)</td>
<td>483 (36.85%)</td>
<td>9 (1.86%)</td>
<td>899</td>
<td>27 (2.78%)</td>
</tr>
<tr>
<td>51 - 57</td>
<td>91 (6.82%)</td>
<td>9 (9.89%)</td>
<td>66 (5.07%)</td>
<td>5 (7.58%)</td>
<td>157</td>
<td>14 (8.91%)</td>
</tr>
<tr>
<td>58 - 65</td>
<td>78 (5.84%)</td>
<td>11 (14.10%)</td>
<td>59 (4.41%)</td>
<td>6 (10.17%)</td>
<td>137</td>
<td>17 (12.41%)</td>
</tr>
<tr>
<td>&gt; 65</td>
<td>85 (6.36%)</td>
<td>14 (16.47%)</td>
<td>62 (4.65%)</td>
<td>9 (14.52%)</td>
<td>147</td>
<td>23 (15.65%)</td>
</tr>
<tr>
<td>All ages</td>
<td>670 (100%)</td>
<td>52 (7.76%)</td>
<td>670 (100%)</td>
<td>29 (4.33%)</td>
<td>1340</td>
<td>81 (6.04%)</td>
</tr>
</tbody>
</table>

### Table III: Cardiovascular Risk Factors by Age group and Gender in Urban Population (n=660)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>20 -50</th>
<th>51-57</th>
<th>58 -65</th>
<th>&gt;65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking (%)</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>(n=244)</td>
<td>(n=253)</td>
<td>(n=39)</td>
<td>(n=35)</td>
</tr>
<tr>
<td>Smoking (%)</td>
<td>131 (53.68%)</td>
<td>2 (0.7%)</td>
<td>19 (48.7%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Cholesterol (mg/dl)</td>
<td>215</td>
<td>229</td>
<td>237</td>
<td>241</td>
</tr>
<tr>
<td>HDL Cholesterol (mg/dl)</td>
<td>39</td>
<td>41</td>
<td>37</td>
<td>39</td>
</tr>
<tr>
<td>LDL Cholesterol (mg/dl)</td>
<td>132</td>
<td>127</td>
<td>139</td>
<td>137</td>
</tr>
<tr>
<td>Systolic BP (mm Hg)</td>
<td>155.6</td>
<td>146.5</td>
<td>167.4</td>
<td>154.7</td>
</tr>
<tr>
<td>Diastolic BP (mm Hg)</td>
<td>91.5</td>
<td>88.5</td>
<td>101.8</td>
<td>99.5</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>28.3</td>
<td>29.2</td>
<td>31.9</td>
<td>33.6</td>
</tr>
<tr>
<td>Diabetes (%)</td>
<td>12 (4.91%)</td>
<td>17 (6.71%)</td>
<td>4 (10.25%)</td>
<td>4 (11.42%)</td>
</tr>
</tbody>
</table>
Table IV: Cardiovascular Risk Factors by Age group and Gender in Rural Population (n=1340)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Smoker (%</th>
<th>Cholesterol (mg/dl)</th>
<th>HDL Cholesterol (mg/dl)</th>
<th>LDL Cholesterol (mg/dl)</th>
<th>Systolic blood pressure (mm Hg)</th>
<th>Diastolic blood pressure (mm Hg)</th>
<th>BMI (kg/m²)</th>
<th>Diabetes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-50 Male</td>
<td>14%</td>
<td>208</td>
<td>47</td>
<td>121</td>
<td>143.8</td>
<td>86.6</td>
<td>24.1</td>
<td>11</td>
</tr>
<tr>
<td>20-50 Female</td>
<td>57%</td>
<td>214</td>
<td>48</td>
<td>119</td>
<td>132.5</td>
<td>82.4</td>
<td>23.4</td>
<td>12</td>
</tr>
<tr>
<td>51-57 Male</td>
<td>2%</td>
<td>223</td>
<td>43</td>
<td>129</td>
<td>155.3</td>
<td>96.7</td>
<td>27.6</td>
<td>6</td>
</tr>
<tr>
<td>51-57 Female</td>
<td>1.4%</td>
<td>230</td>
<td>47</td>
<td>136</td>
<td>143.7</td>
<td>91.4</td>
<td>29.2</td>
<td>5</td>
</tr>
<tr>
<td>58-65 Male</td>
<td>3%</td>
<td>227</td>
<td>47</td>
<td>136</td>
<td>161.2</td>
<td>100.7</td>
<td>30.3</td>
<td>5</td>
</tr>
<tr>
<td>58-65 Female</td>
<td>3.03%</td>
<td>239</td>
<td>45</td>
<td>129</td>
<td>154.0</td>
<td>94.2</td>
<td>31.2</td>
<td>8</td>
</tr>
<tr>
<td>&gt;65 Male</td>
<td>18.82%</td>
<td>238</td>
<td>38</td>
<td>141</td>
<td>172.7</td>
<td>101.1</td>
<td>32.3</td>
<td>7</td>
</tr>
<tr>
<td>&gt;65 Female</td>
<td>0%</td>
<td>244</td>
<td>41</td>
<td>135</td>
<td>166.6</td>
<td>99.8</td>
<td>32.8</td>
<td>9.47%</td>
</tr>
</tbody>
</table>

Discussion

Heart disease has no geographic, gender or socio-economic boundaries. An estimated 16.7 million (29.2%) of total global deaths result from the various forms of CVD. Moreover at least 20 million people survive heart attacks and strokes every year; many require continuing costly clinical care. Many of these are preventable by action on the major primary risk factors: unhealthy diet, physical inactivity, and smoking. More than 50% of the deaths and disability from heart disease and strokes, which together kill more than 12 million people each year, can be cut by a combination of simple, cost-effective national efforts and individual actions to reduce major risk factors such as high blood pressure, high cholesterol, obesity and smoking.

These are no longer only diseases of the developed world: some 80% of all CVD deaths worldwide took place in developing, low and middle-income countries, while these countries also accounted for 86% of the global CVD disease burden. It is estimated that by 2010, CVD will be the leading cause of death in developing countries.

**Extent of the problem:** The major CVDs include ischemic heart disease, cerebrovascular disease (stroke), hypertension, heart failure and rheumatic heart disease. Of the 16.7 million deaths from CVDs every year, 7.2 million are due to ischemic heart disease, 5.5 million to cerebrovascular disease, and an additional 3.9 million due to hypertensive and other heart conditions. In addition, at least 20 million people survive heart attacks and strokes every year, a significant proportion of them requiring costly clinical care, which puts a huge burden on long-term care resources. CVD affects people in their mid-life years, undermining the socioeconomic development, not only of affected individuals, but families and nations. Lower socioeconomic groups generally have a greater prevalence of risk factors, diseases and mortality in developed countries, and a similar pattern is emerging as the CVD epidemic matures in developing countries.

The time lag effect of risk factors for CVD means that the full effect of past exposure to behavioural risk factors, especially among children, will only be seen in the future. Unless preventive and management efforts are embraced worldwide, the global burden of CVD death and disease will continue to rise.

**Why is this happening?** The rise in CVDs reflects a significant change in diet habits, physical activity levels, and tobacco consumption worldwide as a result of industrialization, urbanization, economic development and food market globalization. People are consuming a more energy-dense, nutrient-poor diet and are less physically active. Imbalanced nutrition reduced physical activity and increased tobacco consumption are the key lifestyle factors. High blood pressure, high blood
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choline, overweight and obesity - and the chronic disease of type 2 diabetes - are among the major biological risk factors. Unhealthy dietary practices include the high consumption of saturated fats, salt and refined carbohydrates, as well as low consumption of fruit and vegetables. These risk factors tend to cluster. There are at least 600 million hypertension sufferers worldwide, which is 4.4% of the total global disease burden. Hypertension causes 7.1 million deaths annually i.e. 13% of the total deaths. In Pakistan too the prevalence of hypertension is quite high. It is estimated that over 50% of the population over the age of 50 is hypertensive.

About 56% of heart diseases and 18% of strokes are attributed to total serum cholesterol levels >5.2 mmol /l (200 mg/dl). Dyslipidemias account for 4.4 million deaths annually, which is 7.9% of the total global deaths and 2.8% of the total global disease burden.

Cigarette consumption constitutes the single most important modifiable risk factor for coronary artery disease and the leading preventable cause of death. Nearly 1 billion individuals now smoke worldwide. Smoking has a particularly staggering impact in the Third World: almost one-half billion individuals worldwide will eventually die of smoking-related complications. Even among non-smokers, we now recognize that inhaled smoke, whether from passive exposure or from cigar and pipe consumption, also greatly increases coronary risk. In the United States it accounts for over 400,000 deaths annually.

Compared with non-smokers, those who consume 20 or more cigarettes daily have a twofold to threefold increase in total coronary heart disease. Moreover, these effects depend on dose; consumption of as few as one to four cigarettes daily increases coronary artery disease risk. Smoking acts synergistically with oral contraceptive agents, placing younger women at even higher relative risk. In addition to myocardial infarction, cigarette consumption directly relates to increased rates of sudden death, aortic aneurysm formation, symptomatic peripheral vascular disease, and ischemic stroke. As for coronary disease, the risk of stroke directly increases with the number of cigarettes consumed.

In 2000 there were 177 million people in the world with diabetes mellitus (total world population 6.3 billion). This is predicted to rise to 370 million by 2030 (total expected world population 9.3 billion). Much of this increase would be in the developing countries. In Pakistan there were 4 million people with diabetes in 1998 and an estimated more than 6 million in 2002. This is expected to rise to 16 million in another 5 years. Pakistan is one of the 10 countries in the world with the highest prevalence of diabetes and has one of the fastest increase in the number of diabetics.

There are over 30 million people in the world who are obese (BMI > 30/kg/m²) and another 1 billion who are overweight (BMI 25-30 kg/m²). In Pakistan, where there is also a problem of under nutrition, in 1994 11.6% males and 18.93% females were obese or overweight (WHO global database on BMI).

About 2.7 million deaths annually are attributed to low fruit and vegetable intake. This is estimated to cause about 31% of ischemic heart disease (IHD), 11% of strokes and 19% of gastrointestinal cancers.

Lack of adequate physical activity is directly responsible for 2 million deaths globally every year and is responsible for 3-4% of global disease burden. Physical inactivity contributes to 22% of IHD, 11% of ischemic strokes, 14% of type 2 diabetes, 10% of breast cancer and 16% of colon cancer. Physical inactivity also causes obesity, osteoporosis, falls, low back pain, depression and anxiety.

Seventy five percent of the CVD is attributable to high cholesterol, hypertension, low fruit and vegetable intake in diet, inactive life style and tobacco use. These risk factors also tend to cluster in individuals and the risk for CVD multiplies with addition of these risk factors. Even without taking medication, only by changing lifestyle, IHD can be reduced by 80%, Type 2 diabetes by 90% and cancer by 33%.

Cessation of cigarette consumption constitutes the single most important intervention in preventive cardiology. Smoking cessation alone reduces the risk of a first heart attack by nearly 65 percent.

To avoid CVD one needs to stop smoking; eat more fruit, vegetables, nuts, whole grain and less refined grains; replace saturated animal fats to unsaturated vegetable oil based fats; maintain a normal body weight (BMI 8.5 to 24.9 kg/m²); increase consumption of omega-3 fatty acids from fish oil / or plant sources and engage in regular physical activity of at least 30 minutes daily.

If these simple no-cost measures are adopted many millions of death and disability can be avoided and huge resources spent on treating this disease both by the government and by individuals can be saved.

In Pakistan there is a lack of adequate data on the disease burden of cardiovascular disease as well as the risk factors involved. The present study was carried out to determine the disease burden and risk factors for IHD in Pakistan population.

What can be done? Those who have already had heart attacks and strokes are at high risk of recurrences and death. This risk can be substantially lowered with a combination of drugs - statins for cholesterol lowering, aspirin for people at elevated risk of heart attack and stroke and drugs used for secondary prevention of heart attack, stroke and heart failure.

However, the most cost-effective methods of reducing risk among an entire population are population-wide interventions, combining effective policies and
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broad health promotion policies. These should be the first to be considered in all settings. In many countries, too much focus is being placed on one-on-one interventions among people at medium risk for CVD. A better use of resources would be to focus on those at elevated risk and to use other resources to introduce population-wide efforts to reduce risk factors through multiple economic and educational policies and programs. These risk factors include diet and physical activity. The dietary intake of fats, especially their quality, strongly influences the risk of CVD like coronary heart disease and stroke, through effects on blood lipids, thrombosis, blood pressure, arterial function, atherogenesis and inflammation. Excess salt has a significant impact on blood pressure levels.

Compelling evidence indicates that the following strategies are effective in preventing CVD, and in helping manage the disease:

1. Limit energy intake from total fats and shift fat consumption away from saturated fats to unsaturated fats and towards the elimination of trans-fatty acids;
2. Increase consumption of omega-3 fatty acids from fish oil or plant sources;
3. Consume a diet high in fruits vegetables, nuts and whole grains, and low in refined grains.
4. Avoid excessively salty or sugary foods.
5. At least 30 minutes of regular physical activity daily
6. Avoid smoking
7. Maintain a healthy weight.

Conclusion

Pakistan has a high disease burden of ischemic heart disease and also its risk factors.

References